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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/725,063	12/02/2003	Tadahiro Ohmi	039262-0115	2931

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EXAMINER	
PERT, EVAN T	

ART UNIT	PAPER NUMBER
2826	

DATE MAILED: 02/16/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/725,063	OHMI ET AL.	
	Examiner	Art Unit	
	Evan Pert	2826	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 November 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *25-76* is/are pending in the application.

4a) Of the above claim(s) *25-27,29-60,63-67 and 69* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *28,61,62,68 and 70-76* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *02 December 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *0405*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Priority

1. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Election/Restrictions

2. Applicant's election without traverse of Group II claims 28, 61-62, 68 and 70-76 in the reply filed on November 18, 2005 is acknowledged.

3. Applicant's status identifiers (i.e. all "original") do not properly indicate, "withdrawn." Yet, claims 25-27, 29-60, 63-67 and 69 are withdrawn from consideration, being drawn to non-elected inventions, with no allowable generic or linking claim.

Specification

4. The specification includes informalities:

For example, at p. 1 of the specification, "MOS transistor which includes the MIS transistor" should properly read --MOS transistor, which is a representative MIS transistor-- (because a MOS is a sub-type of MIS).

At p. 4, lines 3-4, "proposal has been made" should read –a proposal has been made--.

At p. 4, "to about 0.6 time in comparison" should be grammatically corrected, such as by changing to –by a factor of 0.6 in comparison--.

The degree symbol for --°C-- is written as "oC" throughout the specification.

Applicant should review the disclosure for correction of informalities not identified by the examiner.

Claim Rejections - 35 USC § 112

5. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 72 and 76 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The term ""H_2O with dissolved oxygen reduced" in lines 9 and 13 of claim 72 is a relative term which renders the claim indefinite. The term "reduced" is not defined by the claim, the specification does not provide a standard for ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably informed of the scope of the invention.

For purposes of examination, any clean "H_2O" with or without an amount of "dissolved oxygen" could be considered to have "dissolved oxygen *reduced*" (the level of oxygen reasonably being considered as "reduced" *relative* to other H_20 having a greater albeit arbitrary quantity of dissolved oxygen).

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

7. Claim 28 is rejected under 35 U.S.C. 102(b) as being anticipated by Meuris et al. [IDS #0405, ref "B3"]:

The Meuris et al. reference discloses a method of manufacturing a semiconductor device (i.e. a MOS capacitor with capacitor dielectric representing a transistor gate oxide for experimentation with varying concentration of NH_4OH from x=0.1 to 1 in a x/1/5 RCA SC-1 per "2. Experimental"), comprising the steps of: preparing a silicon semiconductor surface which has a predetermined crystal plane orientation (i.e. "n-doped <100> Cz silicon wafers"); cleaning the silicon surface with an RCA SC-I cleaning liquid with a reduced OH concentration (e.g. 0.15/1/5 is an RCA SC-1 with "reduced OH concentration" per [0116] of US 2004/0108575 A1 corresponding to the instant case) and forming an oxide film on the cleaned surface by oxidizing the cleaned silicon surface in an atmosphere containing oxygen radicals [i.e. the wafers that were cleaned "were processed together in a thermal oxidation furnace to grow a 15 nm gate-oxide."].

8. Claims 61, 62, 73, 74 and 75 are rejected under 35 U.S.C. 102(b) as being anticipated by US 6,348,157 (IDS #1203, Ref "A2").

Regarding claim 61, the '157 reference discloses a method of manufacturing a semiconductor device (i.e. cleaning for making), comprising the steps of: preparing a silicon semiconductor surface which has a predetermined crystal plane orientation [e.g. "n type (100)" per "Embodiment 3"]; and rinsing the silicon surface by the use of H_2O added with hydrogen [col. 4, lines 57-65] and by applying high frequency vibration to said H_2O to terminate silicon at the silicon surface by hydrogen col. 4, lines 43-56].

Regarding claim 62, "it is preferable that the frequency of vibration be within a range of 500KHz to 3MHz" [col. 4, lines 60-61], and that "the solution was effective from the extremely low added hydrogen concentration of 0.5 ppm" [col. 4, lines 34-36].

Regarding claim 73, the '157 reference discloses a method of manufacturing a semiconductor device (i.e. cleaning for making a semiconductor device), comprising the steps of: preparing a silicon semiconductor surface, which has a predetermined crystal plane orientation [e.g. "an n type (111) silicon substrate" per Embodiment 4]; and cleaning the silicon surface (i.e. "washing" per col. 10, line 1), wherein the cleaning step comprises: processing the silicon surface by the use of: 1) a cleaning solution containing HF (0.5 weight percent hydrofluoric acid) and 2) H_2O with dissolved oxygen of less than 100 ppb (e.g. Table 6 shows a case where dissolved oxygen content was 50 ppb).

Regarding claim 74, a cleaning solution which includes HF is prepared and provided with a vibration frequency not lower than 500 KHz [col. 4, lines 57-65], and H_2O with dissolved oxygen of less than 100 ppb [e.g. 50 ppb] and hydrogen of 0.1 ppm to 1.6 ppm [e.g. 0.5 ppm per col. 4, lines 43-56] also undergoes "preparing."

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 72 and 76 are rejected under 35 U.S.C. 102(b) as being anticipated by US 6,348,157 B1 (Ohmi et al.) or, in the alternative, under 35 U.S.C. 103(a) as obvious over Ohmi et al. in view of NN9201295 (IBM technical Disclosure Bulletin Jan. 1, 1991).

The recitation of "preparing a silicon semiconductor surface which has a predetermined crystal plane orientation" is a patentably insignificant and *unenforceable* claim limitation when speaking of "semiconductor substrates" and "semiconductor wafers." For purposes of examination, all "wafers" and "semiconductor substrates" that are generically stated as such necessarily are prepared (e.g. unpacked) and necessarily have a designed (i.e. predetermined) crystal orientation (Official Notice).

The crystal orientation of a "wafer" is necessarily "predetermined" because the orientation of the wafer is a defining parameter like wattage is a defining parameter of a light bulb [e.g. see applicant's admitted prior art p. 2]. While the language, "preparing a silicon semiconductor surface which has a predetermined crystal plane orientation" is not found *verbatim* in the references, the *concept is necessarily present* unless the semiconductor wafer of the reference is not crystalline, which would be an exceptional case that would be explained in or understood by reading a reference.

For example, in the '157 reference, the "(100)" of Embodiment 3 and the "(111)" of Embodiment 4 are well known "Miller Indices" of crystal orientations of wafer surfaces, and wafers are always "prepared," such as the necessary act of "preparing for the process by obtaining the wafer."

As a 102 rejection

In view of the "H_2O with dissolved oxygen reduced" limitation not being a definite limitation, and therefore not being given significant patentable weight, per th erejection under 35 USC 112, 2nd paragraph above, the '157 reference clearly anticipates by its abstract with col. 4, lines 43-65, since the only limitation not in the '157 patent is the ambiguous-by-being-relative limitation of "dissolved oxygen *reduced*" in an "H_2O".

Alternative 103 rejection

The '157 reference is silent about "H_2O with dissolved oxygen reduced" when the "H_20" is part of a solution of "HF" as is the case in the abstract of the '157 reference.

The IBM '295 reference explains that "deoxygenated HF solutions to etch/preclean silicon wafers" results in "a lowering of the residual interface oxygen levels."

It would have been obvious at the time of applicant's claimed invention to adopt the idea of deoxygenated HF solution in the IBM '295 reference in the HF solution process steps stated in the abstract of the '157 reference.

One of ordinary skill in the art would be motivated to use "H_2O with dissolved oxygen reduced" as part of the "HF with H_2O" in the '157 reference, motivated to "lower the residual interface oxygen levels" [2nd sentence '295 reference].

11. Claims 68 and 75 is rejected under 35 U.S.C. 103(a) as being unpatentable over the '157 reference as applied to claims 61 and 73 above, and further in view of Miyashita et al. (IDS #0405, Ref "B4").

The '157 reference is silent about "the cleaning step is carried out without exposing the silicon surface to an air."

The Miyashita et al. reference discloses that "outside air" has "particles" that are not desirable for a semiconductor wafer to be processed (i.e. "particles from city water and particles from outside air" are targeted for removal).

It would have been obvious to one of ordinary skill in the art at the time of the claimed invention to carry out the cleaning step without exposing the silicon surface to "an air" (e.g. "outside air").

One of ordinary skill in the art would be motivated to carry out cleaning without exposing to "outside air" (i.e. "an air") because outside air (which is "an air") contains particles that are not wanted on the silicon surface [MPEP 2144].

12. Claim 71 rejected under 35 U.S.C. 103(a) as being unpatentable over the '157 reference as applied to claim 61 above, and further in view of applicant's admitted prior art [AAPA, p. 4].

The '157 reference is silent about cleaning a silicon surface with (110) crystal orientation.

By AAPA, "...using the (110) silicon substance makes it possible to raise up the mobility of the p-type transistor...".

It would have been obvious to one of ordinary skill in the art to apply the cleaning method of the '157 reference to clean (110) in addition to the examples of (100) and (111).

One of ordinary skill in the art would be motivated to clean (110) because of (110)'s advantages for faster p-type transistors (i.e. higher mobility p-type transistors).

13. Claim 70 rejected under 35 U.S.C. 103(a) as being unpatentable over the '157 reference as applied to claim 61 above, and further in view of US 6,350,322 (Yates).

The '157 reference is silent about the rinsing step being conducted "in an atmosphere of nitrogen, hydrogen, or mixture of hydrogen and deuterium."

The Yates reference explains that the rinsing vessel is advantageously "filled with a gas that will not react detrimentally with the semiconductor structure." The "preferred gas is nitrogen" [col. 5, lines 4-14].

It would have been obvious at the time of applicant's claimed invention to adopt the nitrogen atmosphere for rinsing a wafer as taught by the Yates reference in the rinsing step of the '157 reference, motivated, for example, to "avoid unwanted oxidation or other contamination" [per col. 5, lines 4-6 of the Yates reference].

Conclusion

14. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Shwartzman et al. (RCA review) is cited, for example, as evidence that the well known "500KHz vibration" limitation in applicant's claims is better known as "megasonics," which can be advantageous compared to ultrasonics in that "cleaning action results from high pressure waves set up in solution, rather than from implosion of bubbles that are generated by ultrasonic vibration" [p. 81].

Kern (Overview...) is cited as a background to cleaning wafers in general, and as background to the "RCA-type" solution recited in the claims [p. 19-22, Table 12].

Bok et al. is cited as particularly relevant to claim 28 at portion of text citing references 3 and 4, clearly anticipating claim 28. Bok et al. also discloses a "(111) atomically flat wafer" (which is a wafer with "Ra not greater than 0.09 nm"), so is *relevant to withdrawn claims such as claim 25.*

Endo et al. is cited for disclosing hydrogen-terminated Si(110) [i.e. (Si(001)], and especially that "the fabrication of a perfect Si surface which is *atomically flat* and free from defects is indispensable," which is especially relevant to withdrawn claims since applicant claims a very "flat wafer" (i.e. Ra less than 0.09 nm) in withdrawn claims.

US 6,416,586 is cited for discussion of the importance of "hydrogen termination" of a "silicon surface" which is important for "making semiconductor devices."

US 5,439,569 is cited for discussing SC1 and SC2 solutions (e.g. relevant to claim 28), where components of solution can be controlled, diluted and modified.

US 6,066,571 is cited for discussing the advantage of removing oxygen from rinse water solution [col. 3, lines 11-32].

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Evan Pert whose telephone number is 571-272-1969. The examiner can normally be reached on M-F (7:30AM-3:30 PM).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nathan Flynn can be reached on 571-272-1915. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

ETP
February 13, 2006

EVAN PERT
PRIMARY EXAMINER